Interventional radiology

Automated percutaneous lumbar discectomy (APLD) – Method and 1-Year follow-up

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Abstract. From July 1989 to June 1991, 135 discs on 129 patients were treated, in about two-thirds at level L4/5 and at the remaining one-third L5/S1. 1.5% (n = 2) failed technically. Sixty-eight patients are in the 1-year follow-up. Average age was 41 years (range 16–68 years). Average pain duration was 12 months, and average aspiration time was 25.5 min (range 15–45 min). All patients had contained disc lesions, suffered from radicular symptoms and had not responded to conservative treatment. 67.1% (group A; n = 45) had a failure rate of 17.8%. Patients with associated degenerations (group B; n = 17) had a failure rate of 35.3%, 80% of the patients with recurrent radicular symptoms (group C, interval patients, n = 6) were free of symptoms. Re-herniation rate in all patients was 2.9%, and the laminectomy rate 4.4%. No major complications were noted. Treated disc level, patient age, aspirated nucleus material and CT changes revealed no correlation to clinical success. Patients with associated degenerations (group B) as well as those with longer pain duration and larger contained disc lesions had a significantly worse outcome.

Key words: Spine surgery – Automated percutaneous discectomy – Lumbar disc herniation

Introduction

Automated percutaneous lumbar discectomy (APLD) or the Onik procedure has been demonstrated to be efficacious in 70–90% [1–14] of treated patients suffering from symptomatic contained disc herniations. Morbidity rates reported are less than 1% [1–14]. APLD is a safe procedure with low risk of discitis and damage to soft tissue, neural and vascular structures. Success rates depend on a proper selection of patients [1]. We have tried to state clearly the indications for the procedure based on results of our clinical study and those of already published literature.

Methods

APLD is an automated aspiration technique for the treatment of contained lumbar disc herniations [1–14]. “Discectomy” is an exaggerated term since only the nucleus pulposus is aspirated and the term “nucleotomy” is more appropriate. The Nucleotome’s function (Surgical Dynamics, San Leandro, California) is shown in Fig. 1.

We performed the Nucleotome procedure in our radiological department under C-arm fluoroscopic control using a digital angiographic table (DSA). The disc space is an avascular compartment, therefore a strict sterile tech-
Fig. 2a, b. CT planning. a Digital radiogram under nucleotomy conditions with patient in prone position places over a bolster to flex the lumbar spine. The one-slice CT is planned through the marked disc level of interest. b One-slice CT enables planning an exact entry point from the midline and avoids puncturing the colon.

Fig. 3. Nucleotome instruments. From top: Flextrocard; Straight cannula; Curved cannula; Trephine; Nucleotome\textsuperscript{a} probe.

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The postero-lateral approach to the disc space was used [15]. It should be noted that the colon may be placed very far posteriorly, particularly in the prone position [18]. A single-slice CT scan was obtained through the disc level of interest, to exclude this [15] (Fig. 2). CT also enabled planning of an exact entry point from the midline [15]. In most cases the disc was entered on the side of pain. Only in one patient, when we failed nerve root passage, we reached disc center from the opposite side.

A 5-mm skin incision was made and the 18 gauge trocar (Fig. 3) was fluoroscopically guided towards the disc center or just slightly posterior. For levels L4/5 and L3/4, we started the puncture in lateral view, controlled the position oblique and a.p. since the L5/S1 level is more difficult, we used an oblique orthograde approach [19] to introduce the trocar. The basic consideration is to find the path to the disc with the central x-ray beam in the way of a triangular window (Fig. 4). The narrow space between patient and x-ray can limit this manipulation depending on the different fluoroscopic equipment used.

When radicular leg pain occurred, the needle was re-directed. When pseudo-radicular pain or local low back pain appeared due to contact with the annulus, which is innervated by the sinuvertebral nerve [20], a small amount of local anesthesia (2 ml Lidocain 2\%) was administered through a 0.7 mm Chiba needle. This needle fits between straight cannula and trocar. To avoid nerve root damage, this was done after passing the annulus with the trocar. For all levels we passed the curved 3.8-mm cannula and dilator (Fig. 3) over the trocar down to the annulus. We prefer the curved cannula to the straight one (Fig. 3) because of its larger radius of action in the way of a rotating ellipse which can even be raised by passing the annulus with the cannula. Before introducing the curved cannula we always dilated the tract first with the 2.8 mm straight cannula, which improves the passage through the lumbar fascia [15]. After correct positioning of the cannula, the inner dilator was removed and the annulus was incised with a 2 mm circular saw – the so-called trephine (Fig. 3). The Nucleotome probe was inserted through the cannula, into the disc and activated (Fig. 8). The aspiration was continued until no further disc material could be obtained.

This study took place at Barmherzigen Brüder Hospital, Linz, Austria and was conducted by both the radiology and neurology departments. From July 1989 to June 1991, 129 patients with 135 disc lesions were prospectively selected for the Nucleotome procedure. The data of all patients who met the clinical and radiological criteria were documented before treatment, after treatment at the time of discharge from hospital, after 6 weeks, 6 months and 1 year. The follow-up examinations were done on outpatient basis.

All patients considered suitable for the Nucleotome procedure were prospectively separated into three selection groups:

In group A, patients who met all criteria listed in Table 3, were accepted. In contrast to group A, in group B, we re-